Report for 2005CA126B: An Economic Analysis of Groundwater Nitrate Pollution Control in Dairy-Intensive Watersheds

Publications

- Articles in Refereed Scientific Journals:
    - Baerenklau, K.A. and N. Nergis. 2006. “Controlling Dairy Nitrogen Emissions: A Dynamic Analysis of Herd Adjustment, Ground Water Discharges, and Air Emissions.” Submitted to American Journal of Agricultural Economics. 49 manuscript pages.

Report Follows

Research Program

The objective of this research program is to develop a mathematical model for assessing the costs of different groundwater nitrate pollution control alternatives in dairy-intensive watersheds, and for designing policies that achieve nitrate standards cost-effectively.

Our modeling approach builds upon previous agricultural economics literature that has recognized the importance of accounting for delayed effects of pollution control policies when assessing the economic efficiency of policy alternatives. Simply put, a longer time lag between the initiation of a source control policy and the realization of reduced damages at a receptor point tends to favor less stringent source control efforts.

In the case of dairy farms, there are three main sources of delay. First, the dynamic nature of managing a dairy herd implies a farmer's optimal response to changing operating conditions will not be instantaneous. Rather, there will be a transition from one herd profile to another. Second, dairies apply organic nitrogen which must be mineralized before it can be leached, and this process takes time. And third, nitrogen leachate must be transported from source to receptor before it causes damage.

Determining the optimal balance between source control and receptor treatment efforts requires accounting for these dynamic processes. Therefore we are modeling each process in a single mathematical framework that allows us to simulate the economic and environmental effects of different nitrate pollution control alternatives. Our model includes: farm-level decision-making, herd and crop production, waste generation and reuse, and fate and transport mechanisms.

To-date we have completed the first three components and now have a working model that predicts the time path of nitrogen emissions to both groundwater and air for a representative California dairy. Our simulations clarify the importance of dynamic elements and demonstrate three main results: (1) dairies are unresponsive to pollution charges unless they are relatively large and financially burdensome for farmers; (2) regulations aimed at controlling only nitrate leaching will cause significant increases in ammonia emissions; and (3) mitigating both nitrogen problems with emissions taxes involves substantial reductions in both herd size and farm profit.

These findings are the basis for a technical presentation to be given at the Annual Meeting of the American Agricultural Economics Association in July 2006, and for a manuscript that currently is under submission at the *American Journal of Agricultural Economics*:

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Information Transfer Program

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